ORIGINAL RESEARCH

A comparative study of effects of sevoflurane and isoflurane on middle ear pressure

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ABSTRACT

Background: When anesthesia is given, inhaled anesthetics are more likely than intravenous anesthetics to enter the middle ear (ME) region and change ME status by increasing MEP. The present study was conducted to compare the effects of sevoflurane and isoflurane on middle ear pressure. **Materials & Methods:** 90 cases of both genders visiting ENT departmentwere divided into two groups of 45. Patients in group I were given isoflurane and group II sevoflurane. Tympanometric functions were evaluated using a middle ear analyzer to confirm the patients' routine immitance screening for ME. The type A curve classification approach, which covers the typical MEP ranges of -100 to +500 daPa, was used to make tympanometric measurements. The following times were recorded: T0, when the patient was seated the day before the procedure; T1, when the patient was supine on the operating table prior to the procedure; T2, after the induction of anesthesia and endotracheal intubation; and T3, just after the anesthetic was removed (T3). **Results:** The mean weight in group I patients was 36.5 kgs and group II patients was 34.7 kgs, height was 123.4 cm in group I and 124.4 cm in group II. ASA grade I was seen in 20 and II in 25 in group I and grade I in 28 and II in 17 in group II. Time of surgery was 35.2 minutes in group I and 29.5 minutes in group II. The mean time of anesthesia was 51.4 minutes in group I and 50.6 minutes in group II. The difference was non- significant (P> 0.05). The mean middle ear pressure in group I at T0 was -19 at T1 was 27, at T2 was 72 and at T3 was 102 in group I in right ear. It was -20, 31, 82 and 132 at T0, T1, T2 and T3 respectively in group II. It was -18, 35, 87 and 118 in group I and -15, 42, 81 in group I and 140 at T0, T1, T2 and T3 respectively in group II in left ear. The difference non- significant (P> 0.05). **Conclusion:** Because the rise in middle ear pressure during isoflurane anesthesia was less than that of sevoflurane, it is safe to use during ENT procedures.

Keywords: middle ear pressure, isoflurane anesthesia, sevoflurane

INTRODUCTION

When anesthesia is given, inhaled anesthetics are more likely than intravenous anesthetics to enter the middle ear (ME) region and change ME status by increasing MEP.[1]The volatile anesthetic medications enter the ME and change the MEP either by diffusion from the circulation or by insufflations through the Eustachian tube.[2] Stapes disarticulation, tympanic membrane rupture, ear pain, temporary or permanent hearing loss, hemotympanium, serous otitis media, tympanic membrane graft displacement, and failure ossicular chain repair are among the outcomes that might arise from an increase in MEP.[3]

It has been reported that an increase in MEP caused by inhalant anesthesia may cause the Eustachian tube to drive effusion out of the ME.[4] If an ear that was diagnosed with otitis media with effusion before to surgery turns out to be dry, this could lead to the wrong decision regarding the installation of a tympanostomy tube.[5] In 3.3% of cases, otitis media with effusion was seen, and some patients may experience negative MEP during general anesthetic surgery. Inhalation anesthesia-induced gas dynamics in the ME cavity and surgically-induced temporary blockage of the Eustachian tube are suggested to be the causes of this condition.[6]The present study was conducted to compare the effects of sevoflurane and isoflurane on middle ear pressure.

MATERIALS & METHODS

The present study was carried out on90 cases of both gendersvisiting ENT department. All gave their written consent to participate in the study.

Data such as name, age, gender etc. was recorded. Patients were divided into two groups of 45 and given ENT examinations the day before surgery. Patients in group I were given isoflurane and group II sevoflurane. Tympanometric functions were evaluated using a middle ear analyzer to confirm the patients' routine immitance screening for ME. The type A curve classification approach, which covers the typical MEP ranges of -100 to +500 daPa, was used to make tympanometric measurements. The following times were recorded: T0, when the patient was seated the day before the procedure; T1, when the patient was supine on the operating table prior to the procedure; T2, after the induction of anesthesia and endotracheal intubation; and T3, just after the anesthetic was removed (T3). Results thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table IIntraoperative parameters

Parameters	Group I	Group II	P value
Weight (Kg)	36.5	34.7	0.16
Height (cm)	123.4	124.4	0.57
ASA grade I/II	20:25	28:17	0.92
Time of surgery (mins)	35.2	29.5	0.74
Time of anesthesia (mins)	51.4	50.6	0.82

Table I, graph I shows that the mean weight in group I patients was 36.5 kgs and group II patients was 34.7 kgs, height was 123.4 cm in group I and 124.4 cm in group II. ASA grade I was seen in 20 and II in 25 in group I and grade I in 28 and II in 17 in group II. Time of surgery was 35.2 minutes in group I and 29.5 minutes in group II. The mean time of anesthesia was 51.4 minutes in group I and 50.6 minutes in group II. The difference was non-significant (P> 0.05).

Graph I Intraoperative parameters

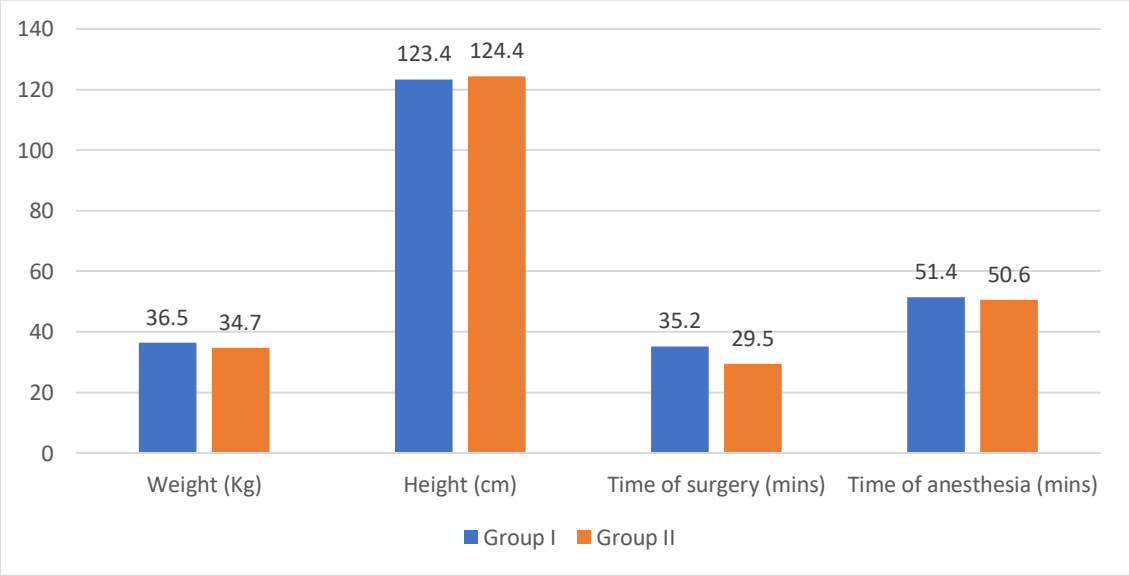

Table II Middle ear pressure

Time of measurement	Right ear			Left ear		
	Group I	Group II	P value	Group I	Group II	P value
T0	-19	-20	0.87	-18	-15	0.35
T1	27	31	0.67	34	42	0.82
T2	72	82	0.79	87	81	0.59
T3	102	132	0.01	118	140	0.02

Table II shows that mean middle ear pressure in group I at T0 was -19 at T1 was 27, at T2 was 72 and at T3 was 102 in group I in right ear. It was -20, 31, 82 and 132 at T0, T1, T2 and T3 respectively in group II. It was -18, 35, 87 and 118 in group I and -15, 42, 81in group I and 140 at T0, T1, T2 and T3 respectively in group II in left ear. The difference non- significant (P> 0.05).

DISCUSSION

Several researchers have documented differences in MEP as a result of inhalant anesthesia; prior research has mostly compared total intravenous anesthetics with propofol to nitrous oxide, halothane, sevoflurane, and desflurane.[7,8] Additionally, it has been documented that volatile anesthetics alter the MEP after entering the ME through insufflations via the Eustachian tube or diffusion from the circulation.[9,10]The present study was conducted to compare the effects of sevoflurane and isoflurane on middle ear pressure.

We found that the mean weight in group I patients was 36.5 kgs and group II patients was 34.7 kgs, height was 123.4 cm in group I and 124.4 cm in group II. ASA grade I was seen in 20 and II in 25 in group I and grade I in 28 and II in 17 in group II. Time of surgery was 35.2 minutes in group I and 29.5 minutes in group II. The mean time of anesthesia was 51.4 minutes in group I and 50.6 minutes in group II. Karabiyik L et al[11] compared complete intravenous anesthesia with propofol-alfentanil and inhalational anesthesia with nitrous oxide and halothane to examine the impact of nitrous oxide on middle ear pressure. Two groups of fifty patients with healthy, normal ears were created. One group (n = 25) received thiopentone (6 mg kg-1) to produce anesthesia, which was maintained with 1% halothane and 66% oxygen nitrous oxide. Alfentanil 25 micrograms kg-1 and propofol 2 mg kg-1 were used to induce anesthesia in the other group (n = 25). The anesthesia was maintained with an infusion of alfentanil 10 micrograms kg-1 min-1 for the first 10 minutes, followed by 0.5 microgram kg-1 min-1 and propofol 10 mg kg-1 h-1 for the first 10 minutes, and 8 mg kg-1 h-1 for the next 10 minutesand 6 mg kg-1 h-1 thereafter. Patients were ventilated with an oxygen-air mixture (F1O2 = 0.33).Middle ear pressures were measured during the pre-, intra- and post-anaesthetic period in both ears. A progressive rise was observed in the first group, whereas values were within the normal limits clinically and there was no statistically significant change in those receiving total intravenous anaesthesia during the intra-anaesthetic period. The time to reach peak pressure with inhalational anaesthesia was 60 min (181.5 mmH2O) and to return to normal was 30 min (49.5 mmH2O) after cessation of nitrous oxide administration. The incidence of nausea and vomiting was less in the patients not receiving nitrous oxide.

We observed that the mean middle ear pressure in group I at T0 was -19 at T1 was 27, at T2 was 72 and at T3 was 102 in group I in right ear. It was -20, 31, 82 and 132 at T0, T1, T2 and T3 respectively in group II. It was -18, 35, 87 and 118 in group I and -15, 42, 81 in group I and 140 at T0, T1, T2 and T3 respectively in group II in left ear.Ozturk O et al[12]assessed how desflurane affected middle ear pressure. 38 ears from 19 male children who were slated for circumcision were included in this investigation. Each ear's baseline tympanometry reading was taken right before anesthesia. Following propofol induction anesthesia, a laryngeal mask was placed and the administration of desflurane began. At five, ten, and fifteen minutes following administration, as well as ten minutes following the termination of desflurane, the subsequent tympanometry reading was obtained. Prior to anesthesia, the mean MEP values in 38 ears belonging to 19 boys were -10.32+/-33.14. Desflurane treatment began with a mean value of 71.15+/-60.42 at minute five, 111.56+/-59.03 at minute ten, and 120.50+/-54.14 at minute fifteen. Compared to the initial value, these readings were significantly higher ($p<0.001$). The mean MEP value decreased to 57.56+/-79.06 after stopping desflurane, however it was still significantly greater ($p<0.001$) than the initial value.

Acar et al[13]determined middle ear pressure changes during the operation performed under anaesthesia induced by isoflurane or desflurane. A total of 38 children with no middle ear pathology scheduled for inguinal hernia surgery were included in the study. Group I (n = 22) received isoflurane and Group II (n = 16) received desflurane. Baseline tympanometry was performed before the anaesthesia on both ears, and tympanometry was repeated 5, 10 and 15 minutes after the administration and 10 and 30 minutes after the withdrawal of anaesthetic agents. The mean middle ear pressure values in the 44 ears of the 22 children in Group I and the 32 ears of the 16 children in Group II did not show any significant difference before the anaesthesia by either anaesthetic agent ($p > 0.05$). Increase in the mean middle ear pressure values at the 5^{th} and 10^{th} minute of the operation was significant different between both groups (2.84 and 5.80 daPa for isoflurane; 59.06 and 72.81 daPa for desflurane; $p \leq 0.05$). Desflurane is more increased than isoflurane on intra-tympanic pressure and isoflurane may be used more safely than desflurane in middle ear operations. The low effect of isoflurane on intra-tympanic pressure can be explained by the high blood/gas partition coefficient compared to desflurane.

CONCLUSION

Authors found that isoflurane anesthetic is safe to employ during ENT procedures since it caused a smaller increase in middle ear pressure than sevoflurane.

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